WHAT IS CLAIMED IS:

1. A bi-directional boost circuit for power factor correction, comprising:

a first diode, a second diode, a first inductor, a second inductor, a first switch, and a second switch to convert an AC input voltage, rectify the AC input voltage, and output an intermediate DC voltage; and

a power factor control circuit to receive the AC input voltage, to receive the intermediate DC output voltage, to regulate the intermediate DC output voltage, and based on the AC input voltage and the intermediate DC output voltage, to control an inductor current waveform to form a substantially sinusoidal waveform that is in phase with the AC input voltage by driving the first switch and the second switch.

2. The circuit of claim 1, wherein the power factor control circuit creates a clipped inductor current waveform if the power factor control circuit is configured with a clipping threshold value and a value of an inductor current is above the clipping threshold value.

3. The circuit of claim 1, wherein the power factor control circuit includes a first current mode controller, a second current mode controller, a pulse width modulator, and a waveform generation circuit, and a pulsed signal output from the pulse width modulator is multiplied by an output of the waveform generation circuit to create a haversign signal that is input to the first current mode controller to drive the first switch and is input to the second current mode controller to drive the second switch.

4. The circuit of claim 3, further including an error amplifier to input a voltage error signal to the pulse width modulator to control a pulse width of the pulsed signal.

5. The circuit of claim 3, further including a comparator to clamp the haversign signal in response to a large instantaneous change in the intermediate DC output voltage.

6. A current waveform control circuit, comprising:

a signal providing circuit to output a haversign signal;

a switch to transfer an inductor current; and

a current mode controller configured with a clipping threshold value to receive the inductor current and the haversign signal, to compare a magnitude of the inductor current to the clipping threshold value, and to generate a driving signal to turn off the switch if the magnitude of the inductor current is greater than the clipping threshold value.

7. The current waveform control circuit of claim 6, wherein the current mode controller is configured with the clipping threshold value by coupling a resistor across two pins of the current mode controller.

8. The current waveform control circuit of claim 6, wherein the current mode controller is configured with the clipping threshold value by software.

9. A power adapter for providing an output voltage and an output current to a portable appliance, comprising:

a bi-directional boost circuit to receive an AC input voltage, including

a first diode, a second diode, a first inductor, a second inductor, a first switch, and a second switch to convert the AC input voltage, rectify the AC input voltage, output an intermediate DC voltage and regulate the intermediate DC voltage; and

a power factor control circuit to receive the AC input voltage, to receive the DC intermediate voltage, to regulate the DC intermediate voltage, and based on the AC input voltage and the DC intermediate voltage, to control an inductor current waveform by driving the first switch and the second switch to create a substantially sinusoidal current that is in phase with the AC input voltage,

a switching device to receive the intermediate DC voltage and to output a switched voltage;

a transformer to receive the switched voltage and to output an intermediate voltage; and

a regulator to receive the intermediate voltage and to output a DC output voltage.

10. The power adapter of claim 9, wherein the power factor control circuit creates a clipped inductor current waveform if the power factor control circuit is configured with a threshold value and a value of an inductor current is above the threshold value.

11. The power adapter of claim 9, wherein the power factor control circuit includes a first current mode controller, a second current mode controller, a pulse width modulator, and a waveform generation circuit, and a pulsed signal output from the pulse width modulator is multiplied by an output of the waveform generation circuit to create a haversign signal that is input to the first current mode controller to drive the first switch and is input to the second current mode controller to drive the second switch.

12. The power adapter of claim 11, further including an error amplifier to input a voltage error signal to the pulse width modulator to control a pulse width of the pulsed signal.

13. The power adapter of claim 11, further including a comparator to clamp the haversign signal in response to a large instantaneous change in the intermediate DC output voltage.

14. A method of power factor correction, comprising:

receiving a haversign signal;

receiving a first inductor current through a first switch;

comparing a magnitude of a haversign signal with a value of the first inductor current; and

generating a first driving signal to turn off the first switch if the value of the first inductor current is larger than the magnitude of the haversign signal.

15. The method of claim 14, further including receiving an AC input voltage at a waveform generator and outputting a haversign waveform;

receiving an intermediate DC voltage and outputting a pulsed signal from a pulse width modulator;

multiplying the haversign waveform and the pulsed signal to produce a multiplied haversign waveform;

receiving the multiplied haversign waveform and outputting the haversign signal;

16. The method of claim 14, further including

receiving a second inductor current through a second switch;

comparing a magnitude of a haversign signal with a value of the second inductor current; and

generating a second driving signal to turn off the second switch if the value of the second inductor current is larger than the magnitude of the haversign signal.

17. The method of claim 16, further including,

receiving the AC input voltage at a first inductor and a second inductor;

rectifying the AC input voltage using the first switch, the second switch, a first diode, and a second diode to produce an intermediate DC voltage.

18. A method of power factor correction, comprising:

receiving a first inductor current through a first switch;

comparing a clipping threshold value with a value of the first inductor current; and

generating a first driving signal to turn off the first switch if the value of the first inductor current is larger than the magnitude of the clipping threshold value

19. The method of claim 18, further including,

receiving a second inductor current through a second switch;

comparing the clipping threshold value with a value of the second inductor current; and

generating a second driving signal to turn off the second switch if the value of the second inductor current is larger than the clipping threshold value.

20. The method of claim 19, further including,

receiving the AC input voltage at a first inductor and a second inductor;

rectifying the AC input voltage using the first switch, the second switch, a first diode, and a second diode to produce an intermediate DC voltage.

21. A power factor correction circuit, comprising:

a first primary winding and a second primary winding of an isolation transformer to receive an AC voltage and an AC current,

a first switch coupled to the first winding and a second switch coupled to the second winding to draw current through the first primary winding and the second primary winding when the first switch and the second switch are turned on;

a control circuit to drive the first switch and the second switch to generate a current waveform for the AC current in accordance with power factor correction requirements;

a first secondary winding and a second secondary winding of the isolation transformer to receive, from the first primary winding and the secondary primary winding, an induced AC voltage and an induced AC current when the first switch and the second switch are turned off; and

a rectification circuit on a secondary side of the isolation transformer to rectify the induced AC voltage and the induced AC current.

22. The power factor correction circuit of claim 21, wherein the first primary winding and the second primary winding are physically separate from each other.

23. The power factor correction circuit of claim 22, wherein a terminal of the first secondary winding and a terminal the second secondary winding are coupled to ground and this results in noise cancellation of the high-frequency common-mode noise generated by high-frequency switching of the first switch and the second switch.

24. The power factor correction circuit of claim 21, wherein the control circuit is configured to turn on the first switch and the second switch simultaneously.

25. The power factor correction circuit of claim 21, wherein during a positive cycle of the AC input, the first switch is turned on and off by the control circuit and the second switch is continuously turned on by the control circuit.

26. The power factor correction circuit of claim 21, wherein the rectification circuit is a first rectification diode and a second rectification diode.

27. The power factor correction circuit of claim 21, wherein the rectification circuit is a first field effect transistor (FET) and a second FET.

28. The power factor correction circuit of claim 21, wherein the power factor control circuit during a positive cycle of the AC input creates a clipped current waveform for the AC current if the control circuit is configured with a clipping threshold value and a value of a current in the first primary winding is above the clipping threshold value.

29. The power factor correction circuit of claim 21, wherein the power factor control circuit, during a negative cycle of the AC input, creates a clipped current waveform if the power

factor control circuit is configured with a clipping threshold value and a value of the current in the second primary winding is above the clipping threshold value.

30. The circuit of claim 21, wherein the isolation transformer includes utilization of planar magnetics.

31. The circuit of claim 21, wherein the isolation transformer includes utilization of solid or stranded wire.

32. A method of providing isolation, power factor correction, and rectification, comprising:

receiving an AC voltage and an AC current at a first primary winding and a secondary winding of an isolation transformer;

generating a current waveform for the AC current in accordance with power factor correction requirements utilizing the first primary winding, the second primary winding, a first switch, a second switch, and a power factor control circuit;

generating a second intermediate voltage and an induced current on a secondary side of the isolation transformer when the first switch and the second switch are turned off by the power factor control circuit; and

rectifying the second intermediate voltage and the induced current to create a rectified intermediate voltage and a rectified secondary current.

33. The method of claim 32, wherein the rectifying of the second intermediate voltage and the induced current occurs utilizing a pair of rectification diodes.

34. The method of claim 32, wherein the rectifying of the second intermediate voltage and the induced current occurs utilizing a pair of field effect transistors.

35. The method of claim 32, wherein the current waveform is clipped utilizing the control circuit if an inductor current has a larger value than a threshold value.

36. The method of claim 32, further including generating high frequency common mode noise, which is capacitively coupled from the first primary winding to the first secondary winding and from the second primary winding to the second primary winding, and canceling the high frequency common mode noise on a secondary side of the isolation transformer because of the configuration of the first secondary winding and the second secondary winding.

37. The method of claim 32, wherein the current waveform is substantially sinusoidal in shape.